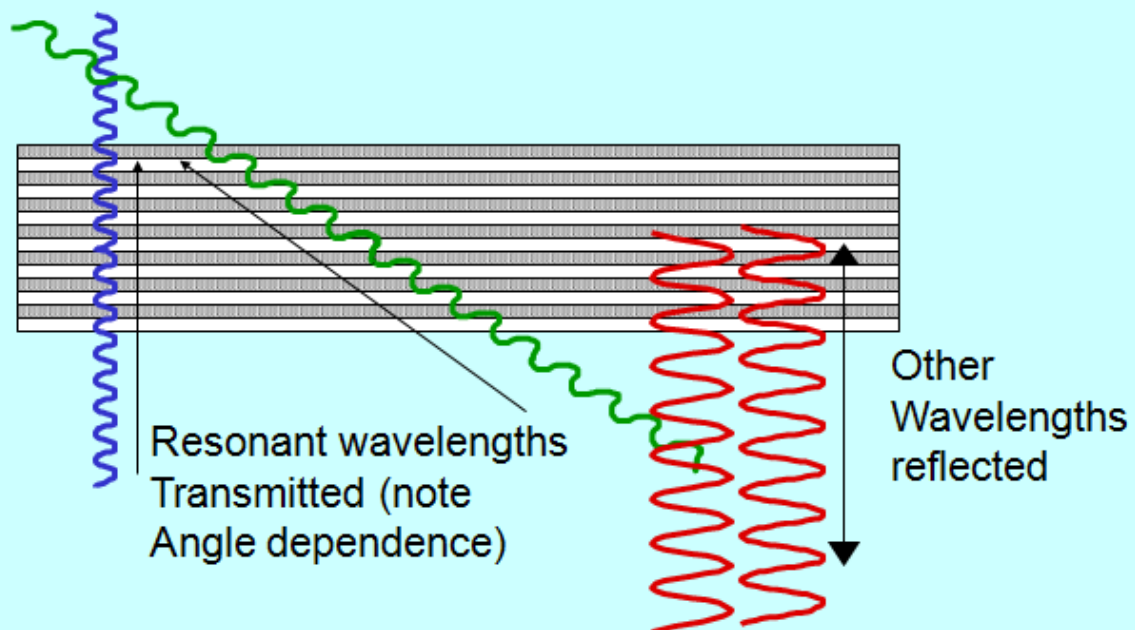


Interference filters

- Also called dielectric filters
- Series of thin layers
 - 2 materials with different refractive index
 - Materials alternate
- Refractive index difference causes reflection
- Boundaries create resonances
 - Resonant wavelengths transmitted

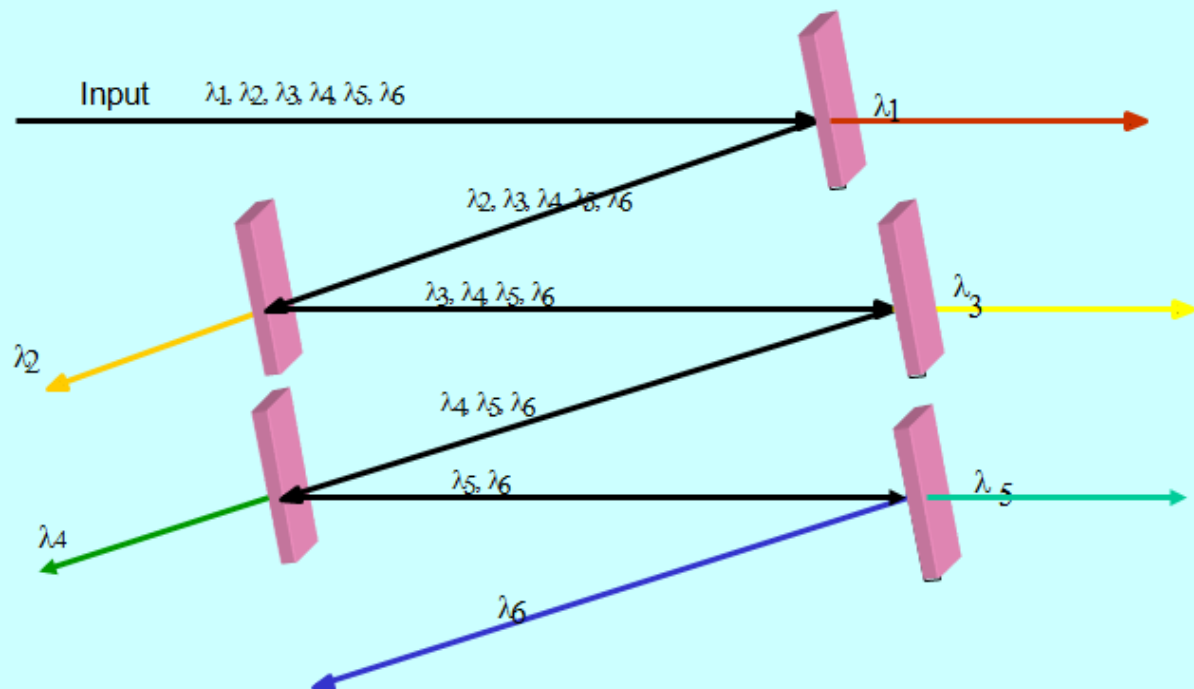
Interference filter operation



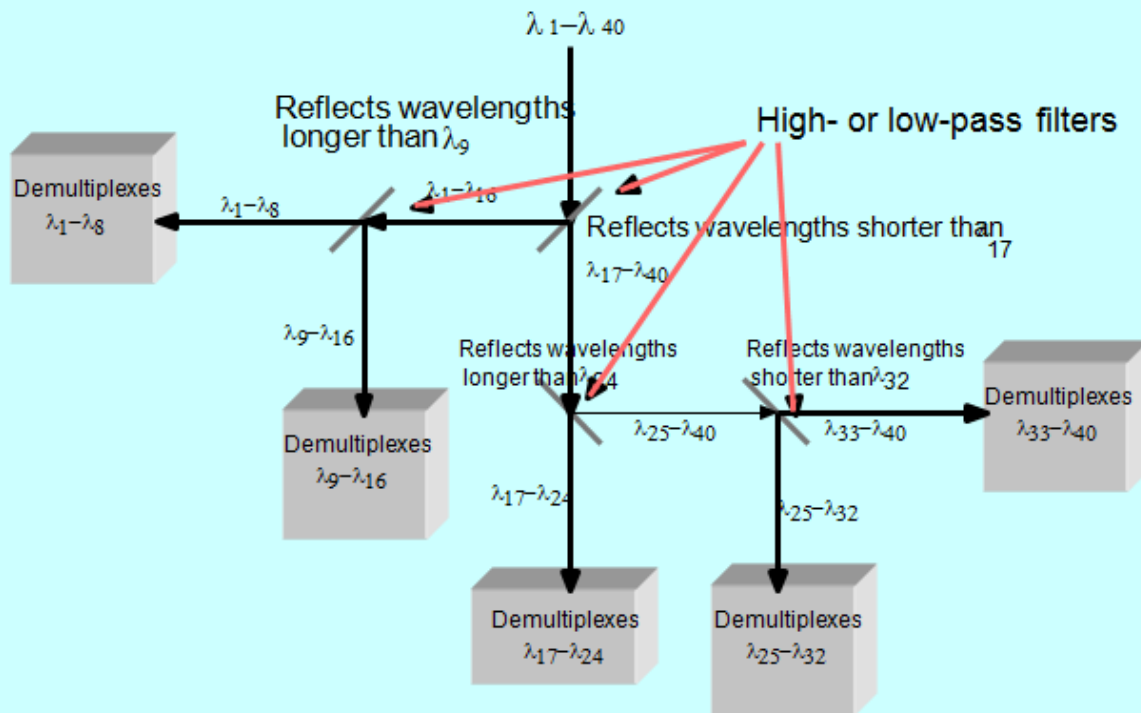
Interference filters for WDM

- Multiple filters needed for WDM
- Pick-off one wavelength at a time
- Pick bands, then individual wavelengths
- High resolution possible
- Many components
- Scalable in increments

One wavelength at a time

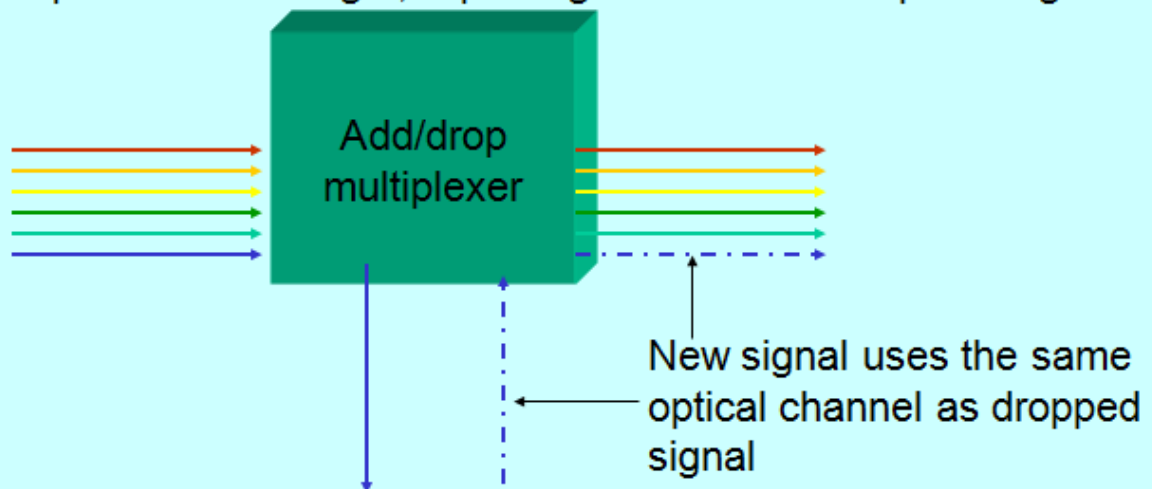


40-channel filter demux



Add/drop multiplexer

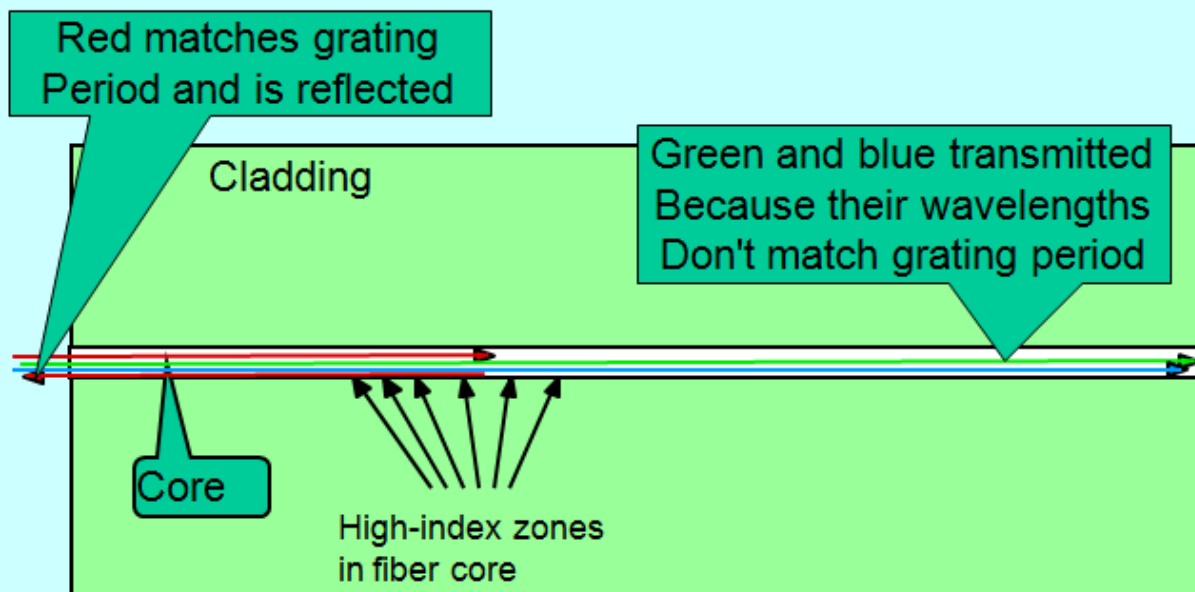
Selects one wavelength (or more) from a transmission line, and drops that wavelength, replacing it with another optical signal.



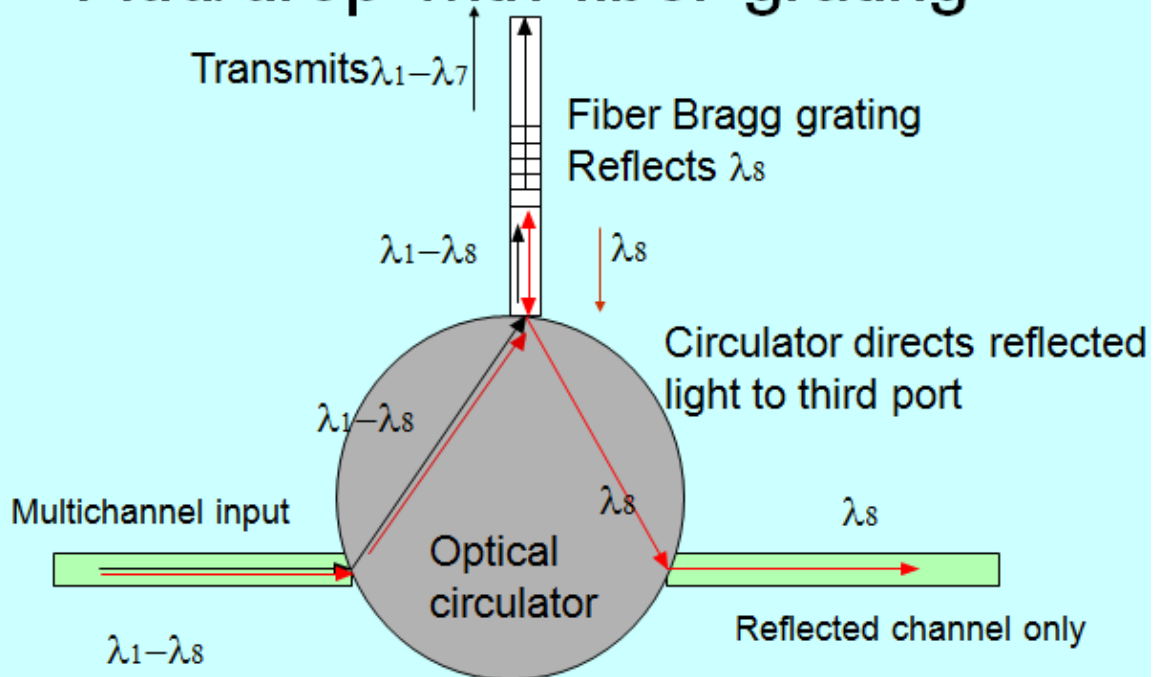
Fiber Bragg Gratings

- Function analogous to interference filters
- Zones of high refractive index scatter light
- Selectively *reflect* one wavelength
 - Transmit other wavelengths
- Like filters, can be grouped to drop one wavelength at a time
- Require an optical circulator
- Fiber components

Fiber grating operation



Add/drop with fiber grating

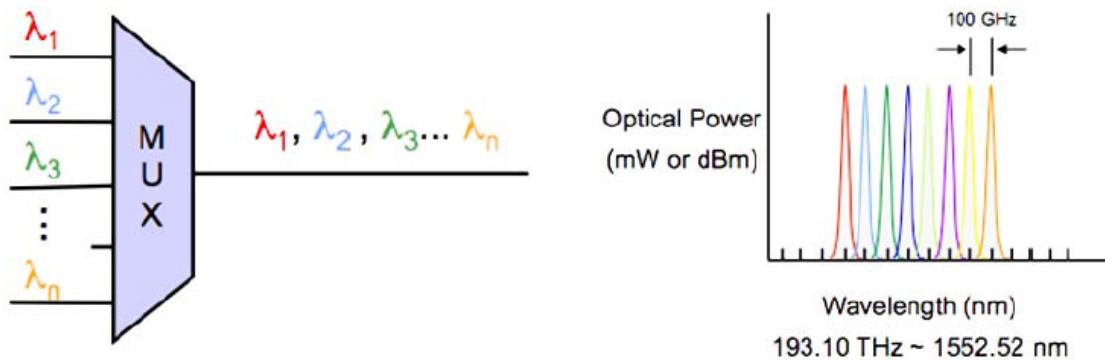


Optical switching

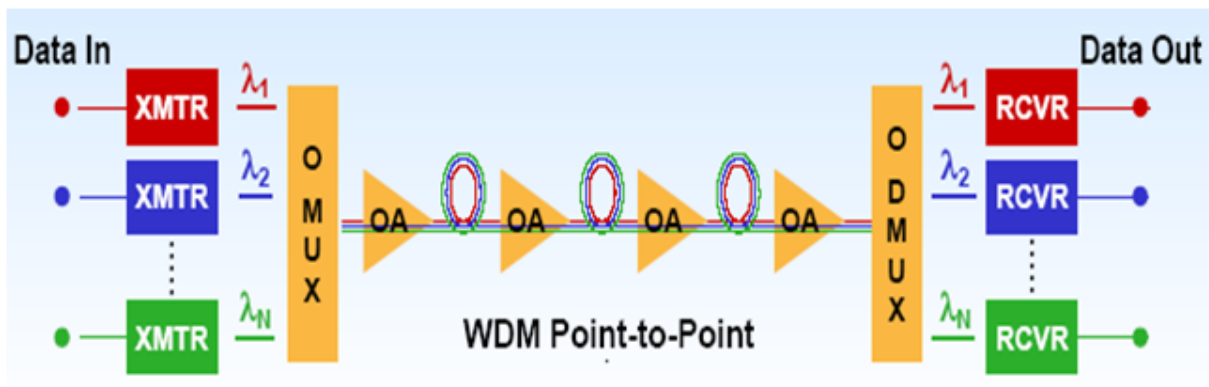
- Essential for optical networking
- Manages signals as optical channels
- Switch one channel or whole fiber load
- Functions
 - Protection switching
 - Provisioning
 - Add/drop switches
 - Cross-connects

Wave Division Multiplexing (WDM)

- What is Wave Division Multiplexing (WDM)?
 - We know that light comes in many different colors.
 - These different colors can be combined on the same fiber.
 - The goal is to have signals not interfere with each other.
 - “Ships in the night” approach.



Wavelength Division Multiplexing



- Passive/active devices are needed to combine, distribute, isolate and amplify optical power at different wavelengths

Why WDM?

- **Capacity upgrade** of existing fiber networks (without adding fibers)
- **Transparency:** Each optical channel can carry any transmission format (different asynchronous bit rates, analog or digital)
- **Scalability**— Buy and install equipment for additional demand as needed
- **Wavelength routing and switching:** Wavelength is used as another dimension to time and space
- Prisms form the basis of optical multiplexing and demultiplexing
 - a multiplexor accepts beams of light of various wavelengths and uses a prism to combine them into a single beam
 - a demultiplexor uses a prism to separate the wavelengths.

